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**TITLE: INTERCHANGEABLE MOLD INSERT SYSTEM****BACKGROUND OF THE INVENTION**

The present invention relates to the field of injection molds, and more particularly, to an apparatus for removing and inserting mold inserts from injection molds.

A conventional injection mold includes a core plate and a mating cavity plate into which the core assembly fits. The cavity and core are movable relative to each other between open and closed positions to define the molding chamber between them in the closed position. Typically, one half of the mold is affixed to a stationary platen (often referred to as the A side of the mold) while the other half (often referred to as the B side) is affixed to a movable platen. Container lids are commonly produced from injection molding process. Often, interchangeable mold inserts are used in injection molds for container lids.

An example of such an insert is a closure insert or an engraving insert for container lids. The purpose of closure inserts is to mold opening configurations such as crimp-on, threaded and push in styles into the lid, which thereby will allow various closure styles to be utilized with the lid. Engraving inserts allow a custom engraving to be evident on the lid. Typically, such inserts are secured on the mold cavity assembly from the face of the mold cavity by means of a mounting screw (as shown in Figure 1 and Figure 2). While it is possible to mount the insert from the rear of the cavity or core, the time and effort necessary for rear mounting of the insert by means of a mounting screw makes it practically infeasible to do so. In order to mount the insert by means of a screw from the rear, the core or cavity plate must be removed from the plate each time. Because inserts, such as closure inserts, may be changed several times a day during mold processing of lids, it is more common to mount the insert from the front of the mold, to allow easy access and speed of changing. With a blank insert, as with a closure insert which forms an opening with a membrane, the central panel of the lid will evidence the boss used to secure the blank in place (as seen in Figure 3). Known means of securing inserts within injection

mold apparatus from the rear do not allow for quick and relatively easy insertion thereof without the removal of the mold plates.

### SUMMARY OF THE INVENTION

It is an object of the present invention to overcome, *inter alia*, the shortcomings of the prior art described above by providing an improved interchangeable insert system for molds. This and other objects are addressed by the present invention.

According to one aspect of the invention, there is provided a mold insert system for an injection mold apparatus comprising a mold cavity plate and a mold core plate each secured to mold bases, relatively movable between open and closed positions, each having opposing faces, said faces meeting to define a mold cavity between the two faces, said cavity defining the shape of a molded article, at least one of said faces defining a facial pocket therein for insertion of a mold insert, said facial pocket defining an insert passageway extending from the facial pocket through the plate and base, said mold insert secured to an insert rod, said insert rod insertable into said passageway to a prelock position, whereat said insert is partially inserted into said facial pocket; locking means operable from the periphery of the mold base connected to said insert rod to move said insert and rod from said prelock position to a fully inserted position whereat said insert is fully inserted within said pocket.

Other advantages, features and characteristics of the present invention, as well as methods of operation and functions of the related elements of the structure, and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following detailed description and the appended claims with reference to the accompanying drawings, the latter of which is briefly described hereinbelow.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIGURE 1 is a partial section view of an injection mold apparatus showing mold inserts inserted in mold plates in a manner known in the prior art;

FIGURE 2 is a perspective view of an injection mold apparatus showing mold inserts secured to mold plates in a manner known in the prior art;

FIGURE 3 is a perspective view of a section of lid produced from a known mold apparatus of the prior art, evidencing the screw boss of the screw used to secured the insert to the mold plate;

FIGURE 4 is a partial section view of a preferred embodiment of the insert system of the invention, shown on the core side (x side) showing a mold insert inserted in a facial pocket of a mold plate in accordance with the invention in an insert pre-lock position and also showing an alternate embodiment of the insert system on the cavity side (y side) of an injection mold apparatus;

FIGURE 4A is a partial section view of the embodiment of FIGURE 4 taken along line C-C;

FIGURE 5 is a partial section view of the embodiments of the insert system corresponding to Figure 4, showing the insert in a fully inserted position within the facial pockets of the plates;

FIGURE 5A is a partial section view of the embodiment of FIGURE 5 taken along line D-D;

FIGURE 6 is a partial section view of the preferred embodiment of the invention, illustrating the insert in a fully inserted position;

FIGURE 7A is a perspective view of the insert rod and insert being positioned into the

facial pocket of the mold plate;

FIGURE 7B is a perspective view of the insert inserted into the facial pocket in a prelock position;

FIGURE 7C is perspective view of the insert inserted into the facial pocket in the fully inserted position;

FIGURE 8 is a partial sectional view of an alternate embodiment of the invention taken along line G-G of FIGURE 4;

FIGURE 9 is a partial section view of further alternate embodiments of the invention;

FIGURE 9A is a partial section view taken along line J-J of FIGURE 9; and

#### **DESCRIPTION OF THE EXAMPLE EMBODIMENTS**

In the description below, like reference numerals are used to indicate components which are similar in the various embodiments of the present invention. As shown in the Figures 1 to 7C, a mold apparatus comprises mold plates 12,14 secured to mold bases 16, 18 respectively. Core plate 12 is secured to core mold base 16. The cavity plate 14 is secured to cavity mold base 18, designed for mating with the core plate 12 such that when the plates are brought together, molten plastic may be injected between the plates, for producing molded plastic products. Such molten plastic is injected between the plate faces in a known manner, typically through a sprue 20 extending through the cavity plate to a nozzle (not shown) leading through the plate faces. Shown in Figures 1 and 2 is a mold insert system of the prior art, showing mold inserts 30 secured to mold plates 12,14, which in turn are secured upon mold bases 16,18. As shown in Figures 1 and 2, the cavity side

(side y) of the mold is shown with mold insert 30 secured to the mold plate by means of a screw 32 inserted from the front of the mold plate 14. As can be seen in Figure 2 and as explicitly shown in Figure 3, the mounting of the screw 32 from the front will show evidence of the screw boss on a molded article 34 when the insert is blank or when a membrane is present over the insert.

Shown in Figures 4 to 7C is an embodiment of the invention which utilizes a cam system to clamp the insert 30 in place within a facial pocket 40 on the mold plate. As shown in Figure 4 (on the X side) a mold insert 30 is secured to an elongate insert rod 36 having a transverse slot 38 extending thereacross. The insert 30 is secured to the insert rod 36 preferably by means of a socket head shoulder bolt screw fastener 37 or any other suitable means. As is illustrated in Figures 4, 5 and 7B and 7C, the mold insert 30 is positioned into a facial pocket 40 on the mold plate 12 shaped to accept the mold insert 30.

The mold insert 30 includes a guide pin 51 on its rear face which is shaped to be inserted into a mating opening 53 in the pocket 40 which assists in proper radial positioning of the insert 30 within the pocket 40. Furthermore, radial locating slots 55 may be present on the insert and the mold face adjacent the pocket 40. The radial slots 55 on the mold face and insert are in alignment when the guide pins are properly inserted into their mating openings. The insert rod 36 may be inserted into an elongate insert passageway 46 extending through the mold plate 12 and into the mold base 16, shaped to accept the insert rod 36. Figure 7A shows the facial pocket 40 shaped to accept the insert 30, which also shows the elongate insert passageway 46. Present within the facial pocket 40 is a spring loaded bumper 50 which acts against the insert 30 to bias the insert 30 in place within the insert pocket 40 slightly offset from being completely inserted in the pocket in the prelock (or offset) position as shown in Figure 4 (X-side) and Figure 7C. Also provided is a heavy tension spring 52 positioned adjacent the lead end 54 of the insert rod. The heavy tension spring 52 is attached between the body of the insert rod 36 and the head of the shoulder bolt screw 37. The body of the insert rod 36 is movable axially relative to screw 37. The spring 52 biases the screw head relative to the rod 36, however the spring 52 will allow

some compression between the body of the rod 36 and the head of the screw 52. When the rod 36 is completely inserted into the passageway 46, the insert is in a prelock (or offset position) shown in Figure 4 (X-side) and 7C, namely with the insert being slightly offset from full insertion into the cavity, thereby allowing manual removal of the insert from the facial pocket. The spring 52 and bumper 50 biases the insert 30 in the prelock position.

As shown in Figures 4 to 6, defined in mold base 16 is a transverse locking passageway 60, extending from a side wall 62 of the mold base, transversely to the length of the insert passageway 46, in communication with passageway 46 thereby allowing access to insert rod 30 when the rod 30 is inserted into passageway 46. Within the transverse passageway 60 is inserted a locking member or rod 64, rotatable about its axis (A-A), which extends therethrough and into the insert passageway 46. The locking member or rod 64 has an offset cam rod 66 extending axially from the end thereof. The offset cam rod 66 may be removable. When the insert rod 36 and insert 30 are in the prelock position, and the locking rod 64 is inserted into the transverse passageway 60, the cam rod 66 engages the insert rod, sitting in transverse slot 38 in the insert rod 36. The locking member or rod 64 may be rotated about its axis A-A by means of a locking handle 70 secured to the outer end of the locking rod 64, adjacent the side wall of the mold base 62. The locking handle is secured to the locking rod by any suitable means and may include a handle grip 75 to assist in operation of the handle. The locking handle 70 extends transversely to the locking rod 64 along the wall of the mold base 62. Rotating the locking handle 70 about the Axis A-A causes the locking rod 64 to rotate such that the offset cam rod 66 positioned within the slot 38, engaging the insert rod 36, moves the insert rod 36 axially (thereby compressing the spring 52 and bumper 50) from the prelock position of Figures 4 and 7C to the fully inserted position shown in Figure 5 (x side), 6 and 7B. In particular, preferably rotating the locking handle 70 from a first position (as is seen in Figure 7C) where the insert is positioned in the prelock or offset position, to a second position (as is seen in Figure 7B), separated from the first position preferably by

approximately 180 degrees, rotates the locking rod 64 and the cam rod 66, sufficiently such that rod 66 engages the wall 38A of the slot 38 and moves the insert rod 36 axially to cause the insert to move from the prelock position (of Figure 4 and 7C) to the fully inserted position of Figure 5, 6 and 7B, where the insert is seated fully within the insert pocket with the insert face flush to the face of the mold plate. Rotating of the locking rod 64 from the second position to the first position causes the insert to be kicked from the fully inserted position of Figure 5, 6 and 7B to the prelock position of Figure 4 and 7C and thereby allows the insert 30 to be manually removed from the pocket 40. The off set cam rod 66 could be rotated completely out of said insert passageway 46 if desired, for example when changing the insert 30 and insert rod 36. It should be understood that the locking rod may be rotated by any other suitable means, such as a rotatable knob secured to the end of the rod or any other type of handle operable from the periphery of the mold base. It should be further understood that the preferred positioning of the locking handle 70 is shown in Figures 7B and 7C only. To aid in the illustration of the parts of the locking handle, its proper positioning is not illustrated in Figures 4, 5 and 6.

The locking handle 70 may be releasably secured in place in each of the first and second positions by insertion of a locking pin 72 (or dowel or the like) therethrough which engages the mold base side wall 62 in an appropriate opening 73 therein. Although not shown, alternately, the locking handle may be inserted in place by means of a spring-ball type lock secured to the locking handle 70 which may sit in a recess in the mold base side wall 62 at the first and second positions. Further alternately, a spring biased grip locking handle (not shown) may be secured to the locking handle which would be biased to sit in recesses in the side wall 62 at the appropriate first and second positions. In order to move the locking handle in such an embodiment, the grip locking handle would have to be lifted out of the appropriate recesses.

The heavy tension spring 52 on the insert rod permits the insert rod to be torqued against the back of the blank insert and allows the shaft to move in a direction along its

axis with a pre set tension. The shaft moves under tension so that when the cam shaft is rotated into the fully inserted locked position, the blank insert will be pulled into a locked position with some cushioning. Having the spring compression provided by the spring 52 allows for tolerance forgiveness. If the spring and/or the bumper are not utilized, and the components are out of position even minimally, the cam shown in C-C would either be loose which would make the blank insert loose or could put it under severe strain as it is being rotated into the fully inserted locked position.

Although described above is the use of the invention with inserts used with container lids, it should be understood that the invention could be utilized to secure an insert to any form of injection mold face. The mold insert could be secured to the cavity side (such as side Y in Figure 4 and 5) of the mold in a like manner to that shown with respect to the core side in the above drawings. Typically, the insert rod 36 used on the cavity side would be shorter in length than the insert rod used on the core side and the locking rod 64' would enter the cavity side plate 14 closer to its face as can be seen in Figures 4 and 5 (on the y side), illustrating an alternate embodiment of the invention (the rack and pinion embodiment as will be discussed below).

Although the above description and drawings shows opening inserts, the insert system of the invention could be used with engraving inserts.

Alternate insert systems which act on the insert rod 36 to bring the insert 30 into the facial pocket 40 may be utilized. For example, shown in Figure 4 and 5 (on the Y side), the cavity side, and in Figure 8, a rack and pinion mounting system is illustrated whereby locking handle 70 causes locking rod 64' to rotate about its axis and cause the gear members 74 to engage mating portions 76 of the insert rod 36' to move along its axis between the prelock or offset and fully inserted insert positions. The gear member must be disengaged from the insert rod to allow removal of the insert from the facial pocket. It should be understood that other means of rotation could be utilized such as knob



positioned on the peripheral end of the locking rod to rotate the locking rod about its axis.

Other alternate embodiments are shown in Figures 9 and 9A. On the y side of Figure 9, the locking handle 70 rotates, actuating a transversal movement of the locking rod 64' or 64". The transversal movement of locking rod 64' and 64" are the same as will be discussed below. It should be understood that such transversal movement may be achieved in any known manner. A slanted profile 101 on the locking rod 64' engages mating slots 82 in the insert rod 36 moving it between the prelock and fully inserted positions as it advances and retracts axially. As can be seen on the x side of Figure 9, locking rod 64" consists of two parts 63A and 63B, threadably engaged together with part 63A being rotatable by the handle 70 to threadably engaging a mating bore in the end of part 63B. Part 63B is prevented from rotation by means of a dowel 164 in notch 165. The dowel may be anchored in mold plate 14 (or alternately in plate 12 or base 16 or 18, depending on which side of the mold this embodiment is utilized with). Part 63A is prevented from moving axially when being rotated into threaded engagement with part 63B and thus 63B is caused to move forward or reverse along the direction T-T as 63A is threadably advanced into 63B. As part 63B advances along the direction of arrow T-T, an angled pin 84 engages insert rod 36" and as part 63B is advances along direction T-T, the angled pin 84 moving forward or reverse along direction T-T causes insert rod and insert to move between prelock and fully inserted positions. Again, it should be understood that the locking rod 64" may be rotated to cause such transversal movement by any suitable rotation means such as a rotatable knob or other suitable means.

Finally, it is to be understood that while certain embodiments of the present invention have been herein shown and described, it will be understood that various changes in size and shape of parts may be made. It will be evident that these modifications, and others which may be obvious to persons of ordinary skill in the art, may be made without departing from the spirit or scope of the invention, which is accordingly limited only by the claims appended hereto, purposively construed.